

NEW STANDARD ACADEMY

Marks: 60

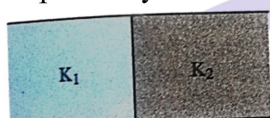
Date : 27-04-2026

CLASS : 12TH

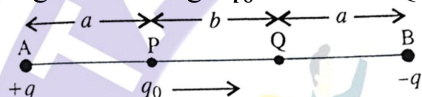
Time: 3 hours

PHYSICS

- Find the ratio of the capacitances of a capacitor filled with two dielectrics of same dimensions but of dielectric constant K_1 and K_2 respectively.

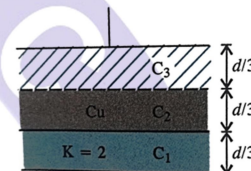


- Two charges $+q$ and $-q$ are arranged as shown in figure. What is the work done in carrying a test charge q_0 from P to Q?



- 2×10^5 electrons pass from a point A towards another point B in a conductor in 10^{-4} s. Find the magnitude and direction of the current. Given $e = 1.6 \times 10^{-19}$ C.
- An electric current of $2.0 \mu\text{A}$ exists in a discharge tube. How much charge flows across a cross-section of the tube in 5 minutes?
- The electron density of conduction electrons in a copper conductor is $8.5 \times 10^{28} \text{ m}^{-3}$. The area of cross-section of the wire is $2.0 \times 10^{-6} \text{ m}^2$ and it is carrying a current of 3.0 A. ($e = 1.6 \times 10^{-19} \text{ C}$). Calculate the drift velocity.
- Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $1.0 \times 10^{-7} \text{ m}^2$ carrying a current of 1.5 A. [Assume that the number density of conduction electrons is $9 \times 10^{28} \text{ m}^{-3}$]
- Two wires A and B of same material have their lengths in the ratio 1: 5 and diameters in the ratio 3: 2. If the resistance of the wire B is 180Ω , find the resistance of wire A.
- A tungsten coil has a resistance of 12Ω at 15°C . If the temperature coefficient of resistance of tungsten is $0.004 \text{ }^\circ\text{C}^{-1}$, calculate the resistance of coil at 80°C .

- A metallic wire has a resistance of 1.1Ω at 20°C and a resistance of 1.7Ω at 100°C . Find the temperature coefficient of resistance of the metal. (α)
- Between the plates of a parallel plate capacitor of area A, a copper plate sits on a dielectric slab of $K = 2$ as shown in Fig. Find the equivalent capacitance of this arrangement.



CHEMISTRY

- The molar conductivity 0.025 mol/L methanoic acid is $46.1 \text{ S cm}^2 / \text{mol}$. Calculate its degree of dissociation and dissociation constant. Given $\lambda^\circ(\text{H}^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$ and $\lambda^\circ(\text{HCOO}^-) = 54.6 \text{ S cm}^2 \text{ mol}^{-1}$.
- If a current of 0.5 ampere flows through a metallic wire for 2 hours, then how many electrons would flow through the wire?
- Calculate the standard cell potentials of galvanic cell in which the following reactions take place:
 $2\text{Cr}(s) + 3\text{Cd}^{2+}(\text{aq}) \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{Cd}$
 Calculate the $\Delta_r G^\circ$ and equilibrium constant of the reactions. (Given $E_{\text{Cr}^{3+}|\text{Cr}} = -0.74$, $E_{\text{Cd}^{2+}|\text{Cd}} = -0.40$)
- Write the Nernst equation and emf of the following cells at 298K
 (i) $\text{Mg}(s) | \text{Mg}^{2+}(0.001\text{M}) || \text{Cu}^{2+}(0.0001\text{M}) | \text{Cu}(s)$
 (ii) $\text{Fe}(s) | \text{Fe}^{2+}(0.001\text{M}) || \text{H}^+(1\text{M}) | \text{H}_2(\text{g}) 1\text{bar} | \text{Pt}(s)$
 (Given $E_{\text{Mg}^{2+}|\text{Mg}} = -2.37$, $E_{\text{Cu}^{2+}|\text{Cu}} = 0.34$, $E_{\text{Fe}^{2+}|\text{Fe}} = -0.44$)
- In the button cells, widely used in watches and other devices the following reaction takes place:
 $\text{Zn}(s) + \text{Ag}_2\text{O}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}(s) + 2\text{OH}^-(\text{aq})$
 Determine $\Delta_r G^\circ$ and E° for the reaction.

- The conductivity of 0.20 M solution of KCl at 298 K is 0.0248 S cm^{-1} . Calculate its molar conductivity?
- Conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity. If Λ_m° for acetic acid is $390.5 \text{ S cm}^2 \text{ mol}^{-1}$. What is its dissociation constant?
- How much charge is required for the following reductions
 - 1 mol of Al^{3+} to Al,
 - 1 mol of Cu^{2+} to Cu,
 - 1 mol of MnO_4^- to Mn^{2+} ?
- A solution of $\text{Ni}(\text{NO}_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode?
- Predict the products of electrolysis in each of the following:
 - An aqueous solution of AgNO_3 with silver electrodes.
 - An aqueous solution of AgNO_3 with platinum electrodes.
 - A dilute solution of H_2SO_4 with platinum electrodes.
 - An aqueous solution of CuCl_2 with platinum electrodes.

BIOLOGY

- What is the phenotypic ratio of the F₂ generation in a standard Mendelian monohybrid cross?
- Which law states that two alleles for a trait separate during the formation of gametes?
- In a dihybrid cross ($\text{AaBb} \times \text{AaBb}$), how many of the 16 possible offspring are expected to show both recessive traits?
- What is the genotypic ratio of the F₂ generation in a monohybrid cross?
- Which Mendelian law is best illustrated using a dihybrid cross rather than a monohybrid cross?
- If you cross a homozygous dominant plant (YY) with a homozygous recessive plant (yy), what will be the phenotype of the F₁ generation?
- What specific type of cross is used to determine whether an organism with a dominant phenotype is homozygous or heterozygous?
- How many different types of gametes can an individual with the genotype AaBb produce?
- In a dihybrid cross (9:3:3:1), what do the "3"s in the ratio represent phenotypically?

- Does the Law of Independent Assortment apply to genes located very close together on the same chromosome?

MATHS

- If $\begin{bmatrix} 3 & -2 \\ 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} y & y \\ x & x \end{bmatrix} = \begin{bmatrix} 3 & 3 \\ 3y & 3y \\ 10 & 10 \end{bmatrix}$, then the value of xy is _____.
- Consider a matrix $A = [a_{ij}]_{3 \times 3}$, where $a_{ij} = \begin{cases} i-j, & \text{if } i \times j = \text{odd} \\ i^2, & \text{if } i \times j = \text{even} \end{cases}$. If b_{ij} is cofactor of a_{ij} in matrix A and $d_{ij} = \sum_{k=1}^3 a_{ik} b_{jk}$ then the value of $\frac{1}{2} \left| \sqrt{\text{det}[d_{ji}]} \right|$ is _____ (Where $[\cdot]$ and $|\cdot|$ represent matrix and modulus)
- Let matrix $A = \begin{bmatrix} x & y & -z \\ 1 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$, where $x, y, z \in N$. If $|\text{adj}(\text{adj}(\text{adj}(\text{adj}(A))))| = 4^8 \times 5^{16}$, then the number of such matrices A is _____
- Find a matrix A such that $2A - 3B + 5C = O$ where $B = \begin{bmatrix} -2 & 2 & 0 \\ 3 & 1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 0 & -2 \\ 7 & 1 & 6 \end{bmatrix}$.
- If the matrix $\begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is symmetric, find the values of a and b.
- If $0 < x < \pi$ and the matrix $\begin{bmatrix} 2 \sin x & 3 \\ 1 & 2 \sin x \end{bmatrix}$ is singular, find the values of x.
- Using matrix method, solve the following system of equations:
 $3x + 2y - 2z = 3$
 $x + 2y + 3z = 6$
 $2x - y + z = 2$.
- For the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & 1 \\ 1 & -1 & 2 \end{bmatrix}$ show that $A^2 - 5A + 4I = O$. Hence, find A^{-1} .
- Let $S = \left\{ A = \begin{bmatrix} a & b \\ b & d \end{bmatrix} \mid a, b, c, d \in \{0,1,2,3,4\} \text{ and } A^2 - 4A + 3I = 0 \right\}$ be a set of 2×2 matrices. Then the number of matrices in S, for which the sum of the diagonal elements is equal to 4 is _____
- If the system of equations
 $x + 5y + 6z = 4$
 $2x + 3y + 4z = 7$
 $x + 6y + az = b$
 has infinitely many solutions, then the value of a is _____